# MALAYSIAN SMALL AND MEDIUM INDUSTRIES (SMIs): PRIORITY AND MODEL OF PRODUCT DESIGN PROCESS

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## ABSTRACT

The main purpose of this paper is to explore, identify, and prioritise the factors and product attributes considered by Malaysian Small and Medium Industries (SMIs) when designing and redesigning their products, and in managing their companies design process. The core data and information were gathered through a survey (mailed questionnaires) from a total of 137 respondents of Malaysian SMIs and a programme of semi-structured interviews from 28 managers of Malaysian SMI's (though additional interviews were also conducted). The findings of the study revealed that Malaysian SMIs are generally not effective in designing products for the export market. The study also revealed that the effectiveness in the product design process is better integrated through cross-functionally team. In addition, the findings and discussed contained in this study have resulted in proposing a model of the product design process. Finally, the researcher has several prioritised recommendations for practitioners and suggestions have been highlighted for the future researchers, government and its agencies, and policy makers.

## INTRODUCTION

This paper considers the product design process in Malaysian SMIs (small and medium industries), particularly in the manufacturing sector. The manufacturing sector is the main player in the country's continued economic development, producing products and services mainly for the local market and for foreign markets. SMIs (known more generically in other countries as SMEs, small and medium sized enterprises) are an important constituent in the supply chain of most industries, and are often end producers in their own right.

The Malaysian SMIs need to have competitive advantage and create differentiation of products to distinguish them from the offerings of other companies, particularly in Malaysia and beyond. In addition, the Malaysian SMIs have been struggling to survive and to design and develop products that meet customer requirements and needs in the competitive global environment. The competition could be in terms of costing (fixed and variable costs) and non-costing or services (quality, design, processes of the products). There are factors to be considered for the design process

such as before the processes (inputs), during the processes (transformation), and after the processes (distribution of finished products and further product and process development) that could be classified as both price and non-price factors. Hence, the quality of management of the design process is important and should be efficient enough to cater for the whole product design processes.

Design is an important concept in the manufacturing process which, if managed effectively, will inevitably involve a multidisciplinary process and a multifunctional cooperation in the company. Product design is a process of developing ideas, imagery and metaphors carried out by various team members (Sharifi and Pawar, 1996) to visualize and envisage the future products that comply with customers' needs and requirements. From the start of the process, at a conceptual stage, team members should discuss and share their assumptions and ideas about the future products that might involve the product processes and specification, product attributes or priorities and marketability of the product in the open market. In addition, Sharifi and Pawar (1996) also suggested that the product design process "contains a conception of the market or customer requirements, a translation of these requirements to specification for drawing, for production and for the preparation of the manufacturing process". Hence, the product design process involves conceptual design, product design, and the production of the products.

Once the products are in the market, SMIs must continue thinking about how to make improvements and further develop and improve the products in order for them to remain competitive or, indeed, increase their value in the eyes of customers. This can be achieved by making essential improvement to and developing existing products, or focusing on the improvement of the manufacturing processes for the product, or both (simultaneous or concurrent engineering. It is also necessary to give priority to both the efficient and effective supply chain management of incoming materials and distribution of the finished products.

The awareness of market and customers' needs is fundamental during the product design process. All these factors must be integrated and incorporated into the design process by the company's design function and/or via cross-functional teams. However, senior management play an important role and would be able to accept the adaptation and the adoption in the process as an inevitable strategic consequence. Change is always a feature of the successful company. Consider the physical appearance (aesthetics) of the product, the production process, the design management team, reliability, performance, economic concerns and many other factors in the product design process.

## MALAYSIAN SMIs

### History of Malaysian SMIs

Since the independence of Malaysia the number of SMIs has increased progressively. Nowadays SMIs mostly act as supporting companies in the supply chain (e.g. as suppliers of raw materials or components) to multinational corporations (MNCs) and large domestic producers. The history of small trading and small business activities

in Malaysia dates back to the Malacca Sultanate during the fifteenth and early sixteenth century (1400-1511). Malacca historically, and until the start of the twentieth century, was been the most important port or trading centre in South East Asia due to its location between China and India. Over the past century international trade has developed substantially. SMIs, to compete in world markets, have needed to be aggressive and rigorous in their strategies. In the last thirty years there has been a shift in employment in that descendents of these migrants have moved from primary to secondary and tertiary industries, and many into employment in today's SMIs.

**The Definition of SMIs and SMEs**

Different countries have their own qualitative definitions and have used different criteria to determine objective definitions (more commonly referred to in most economies as Small and Medium Enterprises, SMEs) such as the amount of capital, the number of employees (part time or full time), total volume of sales turnover, differences between sectors (e.g. manufacturing and services), and amount of invested capital production capability (APEC, 1998). Malaysia is no exception; different agencies, statutory bodies, or researchers generate their own definitions for their own and differing purposes.

Initially, the definition of SMIs was outlined in the Industry Coordination Act 1975, the Act was later amended in 1985 and finally was amended to widen the scope of the definition by expanding the number of full-time employees to not more than 75 employees and paid-up capital to not more than RM2.5 million (Abdullah *et al*, 2002). Furthermore, SMIDEC defines SMIs as "a company with an annual sales turnover of not exceeding RM25 million and with full time employees of not more than 150" (http://www.smidec.gov.my -- May 2001) with the effective date of 18 January 1998. Meanwhile, SMIDP (2002) defines SMEs as "Small and medium enterprises (SMEs) with annual sales turnover not exceeding RM25 million OR full-time employees not exceeding 150" for manufacturing and manufacturing-related services.

**The Roles of Malaysian SMIs**

The structure of the Malaysian economy changed from a reliance on resource-based industry to an industrial base, with the emergence of the electronic and electrical, the textile and clothing, and the machine and equipment sectors. During this time, the Malaysian government has taken initiatives to evolve from commodity-based to the manufacturing-based business by inviting foreign expatriates or multinational corporations (MNCs) to invest and open factories in Malaysia, with the provision of several incentives. Thus, the employment structure has changed significantly to that shown in Table 1.1 (2001 figures).

**Table 1.1: Employment structure in 2001**

| Sectors | Percentage |
|---|---|
| Agriculture | 17.0 |
| Mining | 0.4 |
| Manufacture | 24.1 |
| Construction | 8.5 |
| Services | 49.9 |

Source: SMIDP, 2002

Malaysia has recognised the importance of SMI development since the early 1960s, although SMIs (somewhat disparagingly known as "petty traders" before independence in 1957) have been in existence since the fourteenth century. In the early years of independence, the government placed emphasis on the establishment of firms. Then, in the early 1980s, the government realised it was time to develop and enhance the capability of the Malaysian SMIs, particularly in those supporting industries and supply chains to the leading companies and MNCs. In the 1990s, the government introduced initiatives to strengthen the supporting industries by benchmarking the development of smaller firms in the developed countries in order to identify those that are very efficient and effective in supporting the leading companies. The supporting industries became linked to the leading companies through being suppliers, sub-contracting, and vendor development programme (VDP) systems. In the late 1990s and early 2000s, there was a global a trend of emphasizing the quality of products and services, from which Malaysia could not be excluded.

Thus, SMIs were considered to be major players in the development of the country's economy and in the development of its business enterprises. Primary industries were the leading sector in the Malaysian economy in the early years. However, the growth of the manufacturing sector has resulted in a decline in the primary industries. Most countries have put more emphasis in recent years on the development of SMEs and have eventually developed them into bigger companies or multinational corporations (MNCs) thorugh programmes of growth. Domestic SMIs have the potential to develop into the open market and be global players amongst the world corporations.

Amongst the roles that could be played by Malaysian SMIs are the creation of job and employment opportunities for local people, the generation of income and a better way of life, the smooth process of technology transfer and know-how, the training and development of employees, and the promotion of the Malaysian SMIs through cooperation and collaboration with the MNCs as suppliers or complementary services.

Malaysian SMIs can be categorised into four main categories: agriculture and natural product-related industries, construction industries, service industries, and manufacturing industries. However, SMIDEC identify four sectoral clusters of SMIs

in the manufacturing industries, namely the electrical and electronic industry group, the transport equipment industry group, the machinery and engineering services group, and the wood-based product sector.

## LITERATURE REVIEW

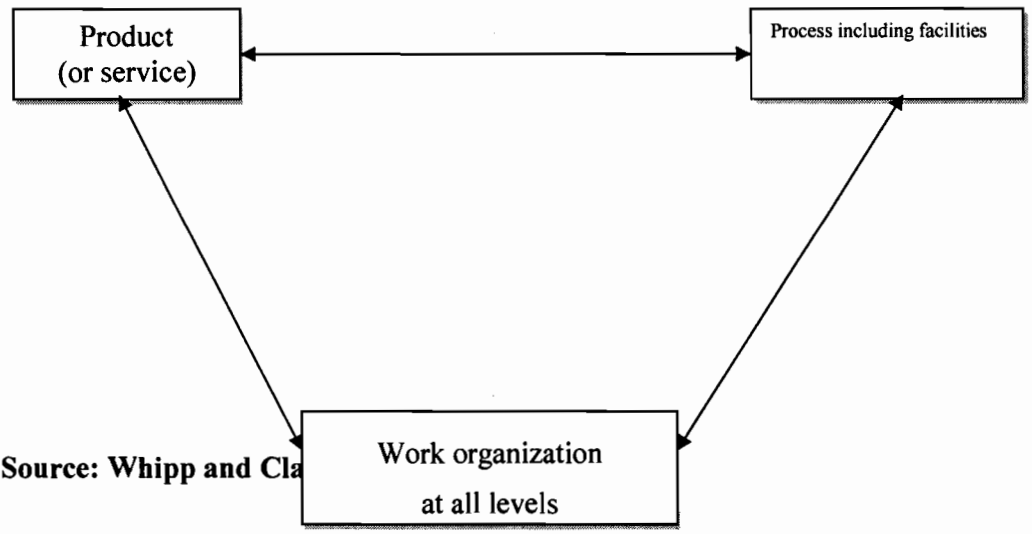
### Overview

Many Malaysian manufacturing companies are currently unable to compete effectively and sell their products in the world markets. Many Malaysian companies have failed to effectively operationalise their conceptual ideas at the initial stage of the new product design process, have had product design projects cancelled during the design and development process, or have launched what they believed to have been attractive products only to have them fail in the marketplace.

A number of researchers have analysed design processes. A useful model of decision-making was initially developed by Mintzberg *et al* (1976), and then adapted by Bennett *et al* (1990) for use in analysing technical design projects. The model provides a useful basis for structuring the analysis of product design processes, and, being generic in nature, is valid for use in Malaysian SMIs. In addition, Bennett *et al* (1990) suggested one further stage, "implementation". This implementation stage is important so that one can incorporate the possibility of "interruptions", "delays", or "any changes needed" after the authorisation stage in the design process.

Utterback and Abernathy (1975) proposed a model of process and product design by distinguishing between product, process, and work organization design (refer Figure 1.1). Abernathy (1978) went on to use this framework in his analysis of the US automobile industry by investigating design and productivity improvement. Meanwhile Whipp and Clark (1986) employed this model and suggested an additional temporal dimension, adding the periodisation of conception, translation, commissioning, and operation to act as a second dimension to the type of innovation.

**Figure 1.1 The triangle of design dimensions**




**Source: Whipp and Cla**

McLoughin and Clark (1988) offered another framework in their study of technological innovation in BT by identifying five periods of design: initiation, decision to adopt, system selection, implementation, and routine operations. This framework provides a structure of analysis and explanation of how technologies shape the organization once they have been chosen.

Schilling and Hill (1998) suggested that companies have to tackle four strategic issues in order to succeed in product development (design): technology strategy, organizational context within the company, the formation and use of teams, and the use of tools.

**What Do Customers "Value" in Products?**

In order to satisfy domestic and international customer needs and expectations, companies needs to formulate product strategies that enable them to differentiate their products from their competitors in the global market (Burpitt & Rondinelli, 2000). Today, customers demand more customised and personalised products and are very discerning about certain products.

Product attributes help to communicate messages about the product and provide information to customers, as well as marketers. Companies use product attributes to market their products while consumers use product attributes in evaluating and comparing a particular product in order to discover what benefits they receive when purchases have been made. Thus, in the end, the consumer benefits by being able to buying a product in terms of the values they desire (Puth *et al,* 1999). Customers purchase products for a range of uses and reasons such as taste, emotion and fashion, service and financing, security, performance, aesthetics, convenience, economy and reliability (Walters and Lancaster, 1999); functions, and features (Prasad, 1998); price, quality, and delivery (Howard, 1998); and the classic retail options of product range, display and store location, and a loyalty card (Clemmet, 1998).

Product attributes can be categorised into product development, brand extension, and product positioning (Viswanathan and Childer, 1999); speed, efficiency, and quality (Goldense, 1994); colour (Puth, *et al,* 1999); time compression, concurrent engineering, quality function (during designing and development) and agility (Prasad, 1998), and price and delivery (Howard, 1998), features, convenience and value, service after sale, product design, etc. The other product attributes and value analysis are divided into five broad different areas: ergonomic, economic, technical/technological, aesthetic and environmental.

**Team Working and Multifunctional Design**

Several issues may arise in relation to team working and multi-functional design teams within the Malaysian companies. Pawar and Sharifi (1997) use the term 'multidisciplinary teams' instead of cross-functional teams and define these as centring ".... around the gathering together of people with specialised skills, experiences and perspectives....". Usually cross-functional teams are established for a specific task, product development, or a process that needs to be solved. The team

members have to work together on certain tasks and develop an understanding of the other's department functions. The company needs capable, efficient, and sufficient number of staff with a variety of skills within the company to develop the product design process. Therefore, cross-functional team should consist of individuals from all functional backgrounds. This provides several advantages by providing a broader knowledge and increasing the cross-fertilisation of ideas.

## RESEARCH METHODOLOGY

A triangulation method (quantitative and qualitative) was used in the study which has been viewed as complementary methods that strengthen the overall results of this study. The core data and information were gathered through a survey (mailed questionnaires) from a total of 137 respondents of Malaysian SMIs and a program of semi-structured interviews from 28 managers of Malaysian SMIs (though additional interviews were also conducted). In addition, the main purpose of the fieldwork was to discover how Malaysian SMIs practise the activities of product design in their daily operational activities, and therefore how they generate product attributes.

## FINDINGS

### Overview

Malaysian SMIs must not forget the company's product design activities. The design department contributed 28.9%, senior executives (26.5%), and manufacturing/operations department (14.9%) toward the company's design process. Meanwhile, designers (36.1%), senior executives (26.1%), and manufacturing/operations (23.5%) are those that led and managed the company's product design projects.

The important factors considered by the Malaysian SMIs during their product design process for local customers were purchase price for customers (47.6%), technical performance of products (29.0%), and customisation to direct customer need (8.1%). On the other hand, the technical performance of product (42.4%), the purchase price for customer (27.5%), and the build quality of product (13.6%) are the factors considered for foreign customers in their company product design process (refer Table 1.2 for details).

**Table 1.2 Factors for local customers and foreign customers**

| No. | Factors | Local (%) | Foreign (%) |
|---|---|---|---|
| 1 | Purchase price for customer | **47.6** | **27.4** |
| 2 | Technical performance of product | **29.0** | **43.2** |
| 3 | Customisation to direct customer need | **8.1** | 4.2 |
| 4 | Fashion trend | 4.9 | 6.3 |
| 5 | Economy of use for customer | 4.0 | 2.1 |
| 6 | Build quality | 3.2 | **13.7** |

| | | | |
|---|---|---|---|
| 7 | Aesthetic & product styling | 1.6 | 3.1 |
| 8 | Ergonomic value or ease of use of product | 0.8 | 0.0 |
| 9 | Environmental or "green" factors | 0.8 | 0.0 |

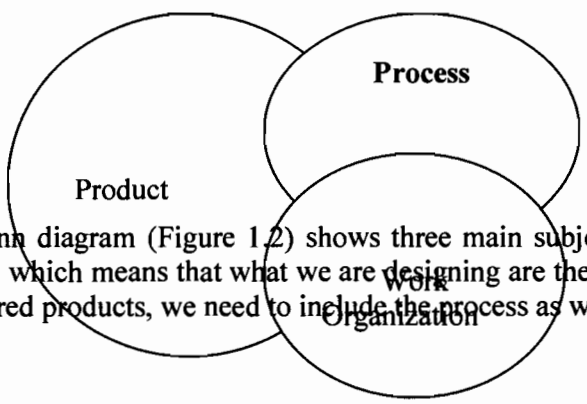
Overall, the respondent company choice is cost of manufacture (22.7%), followed by technical performance of product (17.7%) and customisation to direct customer needs (16.8%) are their company's priorities in designing or redesigning products and variations of choices of Malaysian SMIs..

Most respondents agreed that the used of cross-functional teams (CFT) definitely enhance their design and redesigning product design process. Therefore, most Malaysian SMIs do have specific team members for specific task which better integrated through involvement of representatives from different functions within the company. In addition, they used different name for CFT in or outside their organization.

This study relates to the concept of the product design process. This concept and product attributes as was found in the marketing and operations management literature will benefit SMIs by improved trade performance which they will achieve through improving their product attributes and values. It will be achieved through intelligent use of the product design process and the application of the general principles of value management. The combination of product attributes and values will produce a "lean design" of the company's product which eventually should improve the company's performance.

Nowadays, the design process has been assumed to be an innovative process. However, the improvement of the design process is a continuous one based on the current needs and requirements of the company. The findings from the literature will be developed in order to generate a model of a framework of the product design process. In addition, the findings from the study will be incorporated to support the proposed model. Therefore, the researcher will employ the model by Utterback and Abernathy (1975) as a basic model which emphasises three main factors in the design process, namely; product, process, and work organization design (refer Figure 1.2).

**Figure 1.2 Product Design Process**




The Venn diagram (Figure 1.2) shows three main subject or element in the design process, which means that what we are designing are the products. In order to design the desired products, we need to include the process as well as work organization.

Work organization is an important element in the product design process within the company. In the study, the people who are involved in the design process and the management of the company's product design projects are used to determine the effectiveness and efficiency of the company work organization. In addition, the cross-functional teams also play an important role in determining the effectiveness of the company work organization. Without a good working organization, the product design projects cannot make any advancement or progress. Therefore, the efficiency and appropriateness of cross-functional teams are necessary for the success of the company's product design projects. However, the company's top management should give full commitment to and support projects in terms of both financial and non-financial assistance.

It is suggested that the perfect combination of the process and the work organization could be "lean", and then it will improve the product's performance (e.g. quality and technical performance of products) for the local customers and foreign customers. If successfully implemented during the product design process, then the company might practise the concept of "lean design and production" as proposed by Womack *et al* (1990) which is applicable to any business entity.

**The Contributions of the Study**

The findings of the study explore the contributions of knowledge in terms of theoretical, methodological, and managerial aspects to the production's concepts and theories in particular, and focus on the product design process. In addition, this study also contributes to the knowledge of practitioners in the business or any entity that is involved in the designing of the product. However, academia could make use of this study as a basic instrument to enhance future research and make contributions of knowledge to the betterment of the Malaysian SMIs specifically. The policy makers will benefit from this study if they take the appropriate actions and precautions about the current attributes as discussed in previous chapters.

## DISCUSSION

Research could be conducted into how and what are the best techniques or facilities were actually implemented in the companies, especially in the context of different companies and industries. This study would be an exploratory and pre-implementation study to find the most appropriate priority of product attributes and facilities for the companies. In addition, longitudinal studies should be conducted on how SMIs beliefs over time about priorities given to product attributes used in manufacturing their products locally or internationally have changed.

The researcher has focused on the manufacturers' or producers' perceptions, beliefs, and practices for determining priorities in the product design process. More opportunities should be created to allow SMIs to interact with each other, with researchers, and hold open discussions about the recent theories, practices, and methods in enhancing their competitiveness. The discussions could focus on the appropriate priority of product attributes, methods and model of product design

process to be used in a specific company and why one particular method/model is more favourable than other methods.

## CONCLUSION

The study suggests some new findings and results about the factors and priorities (product attributes) in relation to the Malaysian SMIs product design process. In addition, the used of appropriate product attributes priority and model of product design process by the Malaysian SMIs in their design process has given us some new paradigms. However, the vital role of SMIs and government agencies is important to enhance the product design process that will eventually increase the export performance.

The progressive development of Malaysian SMIs will enable them to develop world leading companies. This aim will be achieved through their strong will and effort, and the government's commitment toward the helping them. Close cooperation between the policy makers and the practitioners is necessary to formulate strategies or draft procedures, policies, laws, or instructions to enhance the Malaysian SMIs.

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